

Section 3. School Construction Process

This section defines, in generic terms, the typical design phases of a construction project and provides recommended guidelines for schools and districts to follow when doing technology cabling, hardware and software planning. It includes the main design and construction phases and as such, is applicable to those schools or districts involved in large-scale construction/renovation projects. However, the concepts and recommendations regarding proper planning and key stakeholder involvement are also adaptable and applicable to smaller-scale projects that involve technology upgrades.

The main goal of this section is to provide strategies for injecting the input of various school and district personnel into the design process. These guidelines are not intended to supersede the requirements of the New Jersey Schools Development Authority (SDA). Projects that fall under the full control of the SDA must comply with all requirements of the current SDA design manual. The project deliverables referenced in this section do not comprise an entire list of all SDA required project deliverables. References to sections of the current SDA design manual⁵ are intended to assist those seeking more information. They are not intended to indicate that all school construction projects or technology initiatives must follow the SDA design manual.

I. Design Input Matrix

One of the most important recommendations made by the advisory group is that key stakeholders be involved in all phases of a project. All too often, key individuals, such as teachers or IT support personnel, are not consulted during the design phases. This can result in a technology solution that is inappropriate or underutilized. The matrix below provides a picture of recommended stakeholder participation for the main phases of a typical project. Phases and participation guidelines are further developed in subsections II through VI that follow.

A. Matrix Notes

- It is understood that, depending on the project and how it is organized, there are others (e.g. SDA, project management firm (PMF), if used, or construction manager (CM) if used) that will have review and approval roles.
- The bulleted items after each of the typical design phases are intended to provide the reader a basic idea of what is happening during that phase. They are not meant to reflect all the deliverables required on a large-scale project.

B. Stakeholder Groups Defined

- Superintendent = school district superintendent or designee
- School Board/Buildings & Grounds Committee = can be a previously established school board subcommittee or a committee

⁵ At the time of this document's preparation, the current SDA manual is the 21st Century Schools Design Manual dated May 15, 2007

comprising school board members and district administration formed for a specific project.

- Teachers, Administrators and Support Staff = individuals to provide input from the instructional, operational and administrative perspectives.
- IT Staff or IT Review Committee = members of the IT staff or a committee comprised of IT staff and other teaching or administrative staff.
- Students and Community = representatives from grade levels mature enough to have worthwhile input and from community groups, as appropriate (i.e. parent groups, municipal government, police, local business leaders).

C. Educational Technology Design Process Input Matrix

Design Phase	Superintendent	School Board, Buildings & Grounds Committee	Teachers, Administrators & Support Staff	IT Staff/IT Review Committee	Students, Community
Program/Concept <ul style="list-style-type: none"> Ed Specs Concept Designs Review 	PI, RC, AP	PI, RC	PI, ID, DT	PI, DT, AP, ID	PI, ID, SA
Schematic Design <ul style="list-style-type: none"> Schematic Drawings System Narrative Ed Spec (for DOE) 	PI, RC	PI, RC	PI, ID	PI, DT, AP	SA
Design Development <ul style="list-style-type: none"> Drawings w/Details Specifications E-Rate Package FEA Submit to DOE 	PI, RC, AP	PI, RC	PI, ID, DT, RC	RC, PI, AP, ID, DT	SA, RC, ID
Construction Docs <ul style="list-style-type: none"> Drawings for Bid Specs for Bid Set of E-Rate Docs 	PI, RC, AP	PI, RC	PI, ID, RC	RC, PI, AP	SA
Construction Admin <ul style="list-style-type: none"> Const Observation Sub Completion Post occupancy IT Shop Dwgs As-Built Drawings 	ID	ID	PI, ID, RC	RC, PI	SA

- **AP** = Has **A**pproval responsibility
- **DT** = Part of the **D**esign Team with the Design consultant
- **PI** = **P**rovides **I**ntput during design meetings
- **RC** = **R**eviews & **C**omments on drawings and specifications
- **ID** = **I**nformation **D**issemination: is copied on all correspondence
- **SA** = **S**tudent **A**udit: Students observe all phases for coursework credit (Middle and High School)

II. Program/Concept Phase

In this phase, the design consultant meets with the representatives of all user groups to discuss their expectations, operational practices and other project requirements (i.e. LEED). It is from this series of meetings that the design consultant begins to develop the educational specifications.

The IT staff/IT review committee should be part of all the programming meetings regardless of whether those meetings specifically focus on technology. At these meetings, it is imperative that the educational philosophy of the school be discussed and that the teachers, administrators, support staff, students, community, and any other partners are all represented. It is also during this phase that the design consultant gathers other appropriate information from the district/school. This information may include:

- Three-Year Local School District Technology Plan
- *District-Wide Technology Plan* (Bulletin 21 – NJSDA)
- *The Educational Technology Plan for New Jersey*
- *National Education Technology Plan*
- Equipment Lists, cutsheets, specifications, drawings, written standards from recent projects
- Disaster Recovery/Business Continuity Plans
- NJ Department of Community Affairs (DCA) *Best Practices Standards: Schools Under Construction or Being Planned* (see also Section 5 of this document for more information)
http://www.state.nj.us/dca/codes/misc/pdf/ed_bp_stndrs_11_10_2008.pdf
- Building Program based on DOE Room Lists

At the end of this phase, the design consultant will submit a final program report /educational specification to the Department of Education by way of the design team for approval.

A. Technology Related Deliverables

The design consultant should produce a project approach document that includes a high-level discussion of plans for technology systems and how they relate to the district's curriculum needs. The major concepts of classroom presentation styles, student to computer ratio, convergence, the planned use of wireless devices, ADA requirements, inclusionary education for students with disabilities, assistive technologies and school safety should be discussed in the programming meetings and reflected in the educational specifications. A first draft of the IT plan should be included here.

The programming documents must show compliance with the most current applicable version of the DCA's *Best Practices Standards for Schools Under Construction or Being Planned* addressing safety and security. Specifically, consideration must be given to locating primary and secondary emergency control centers and for video surveillance of all interior and exterior spaces.

B. Who Should Participate

As this is the main information gathering stage of the project, all key stakeholder groups should participate. Special populations should be represented at these initial meetings.

It is highly recommended that the school or district assign an individual to act as project manager. This person should be familiar with the educational and/or operational aspects of the school (e.g. principal, assistant principal, someone from buildings and grounds department, or from the business office). This person would be part of the project team and act as the main liaison between the design consultant and the school. It would be incumbent on the project manager to ensure that all key stakeholder groups are included in the programming meetings.

C. Who Should Review/Approve Deliverables

The technology-related deliverables should be reviewed by the following groups:

- Superintendent
- Board/Buildings & Grounds Committee
- IT Staff/IT Review Committee

The technology deliverables should be approved by the superintendent and the IT staff/IT review committee.

For this and all phases, it is assumed that the Superintendent's approval responsibility covers all aspects of the design and is not limited to the technology components.

III. Schematic Design Phase

Based on the approved program documents, the design consultant begins to lay out the major equipment locations and supporting raceways and conduits. It is imperative that the IT staff/IT review committee work closely with the design consultant during this phase.

Prior to the completion of this phase on SDA and other large-scale projects⁶, the project team is required to submit schematic drawings, educational specifications, and DOE project application forms to the New Jersey Department of Education, Office of School Facilities. (DOE OSF). (a.k.a. - Schematic Educational Adequacy Review Submission)

DOE OSF reviews the project for educational adequacy and compliance with PL 2000, c. 72 and *N.J.A.C. 6A:26*. At this time, DOE OSF prepares a Preliminary Eligible Cost (PEC) determination. If the project is an authority project, DOE OSF also prepares a preliminary project report.

If the district or school has standardized on a certain technology system and if introducing an alternate manufacturer would compromise the operational effectiveness of that system, the district must submit a letter to the design consultant requesting a

⁶ On small-scale projects these submission requirements may not apply.

waiver for the issuance of proprietary specifications at this time. Assume a district had an existing centralized phone and voice mail system. A waiver could be requested by the design consultant to allow for specifying the same centralized system. This would allow the new telephone system to be fully compatible with the existing system. The design consultant will then write an explanation and justification of the district's request and submit this to the SDA for approval.

A. Technology- Related Deliverables

- Outline specifications
- Construction cost estimate
- Proof of compliance with the current DCA best practices standards document.
- Floor plan drawings indicating major equipment room locations, and HVAC and electrical requirements
- Approved IT plan (see Item D below)

B. Who Should Participate?

At this stage, the design consultant is delivering the first iteration of the design documents. They are, by definition, schematic and, as such, would not be informative to inexperienced reviewers. Therefore, the matrix has no involvement assigned for the students and community group with the exception of those students auditing the process.

All other groups would have some level of involvement with the IT staff/IT review committee taking the lead.

C. Who Should Review/Approve Deliverables?

The deliverables should be reviewed by the following groups:

- Superintendent
- Board/Buildings & Grounds Committee
- IT Staff/IT Review Committee

The technology deliverables should be approved by the superintendent and the IT staff/IT review committee.

D. IT Plan Issues

The SDA, in conjunction with the DOE, has developed an IT plan that is used to plan for and procure technology items. (See Appendix D for sample). Based on the number of classrooms, students (with grade levels), specialized spaces (i.e. auditorium, music room, gym, etc.) and particularized needs, the IT plan calculates an efficient IT solution for that school. The equipment identified by the IT plan must be educationally adequate by DOE standards for that specific school. After review and approval by the superintendent and staff, the SDA's procurement office uses the IT plan as the basis for obtaining the equipment. SDA procurement coordinates the technology with school personnel and a technology systems integrator for installation and programming.

Currently, IT plans are not generated or required for non-SDA projects, but will be made available to any district that requests it for their own use.

To avoid coordination problems at the end of the project when the hardware is installed, discussions regarding the IT plan equipment must be initiated in an early design phase. All the information that is required by the design consultant in order to fill out the IT plan should be known at the schematic phase. At this point, the SDA will use this IT plan as a budgeting tool for the technology component of the project.

Currently⁷, for facility projects under SDA control, they procure certain furniture, fixtures, and equipment (FF&E), such as computers, printers and other technology related hardware, outside the main general construction contract.

E. E- rate Program Considerations

Whenever possible, the SDA and/or school district should apply for discounts on the E-rate-eligible technology components being considered for the project. The Schools and Libraries Program of the Universal Service Fund (a.k.a. E-rate Program) makes discounts available to eligible schools for telecommunication services, Internet access, and internal connections. The program is intended to ensure that schools have access to affordable telecommunications and information services.

In a typical school construction project, current⁸ E-rate-eligible components include:

- Voice/data cabling along with associated patch panels, racks, cabinets, faceplates and jacks
- Telephone system, VoIP system (telephone handsets are not eligible)
- Network gear including switches, routers, wireless access points
- Network and E-mail servers (not application or content servers)
- Data protection components (i.e. firewalls, proxy servers, tape backup)
- Power protection – uninterruptible power supply (UPS)/ battery back-up

Seeking E-rate discounts on eligible items introduces complexity to the preparation of construction documents, to the procurement process and to the construction process. E-rate must be a part of document preparation processes at this early phase. Issues include the following:

- The E-rate program requires that the service provider be contracted via a competitive bidding process. On SDA projects, the SDA's typical single prime contract contains too many ineligible E-rate items and cannot be used for E-rate purposes. Therefore, a separate contract must be awarded. This typically

⁷ The method for procuring IT plan components may be different depending on the project. The Design consultant should confirm how technology components are to be purchased early in the design process.

⁸ The E-rate eligible component list is updated annually. Go to <http://www.universalservice.org/sl/> for the latest list.

requires the preparation of a separate set of drawings and specifications.

- On SDA projects, there are some E-rate-eligible items that would be part of the base bid contract (i.e. voice/data wiring and telephone system) and other items that are part of the typical IT plan procurement. (e.g. network switches, routers) Care must be taken to avoid duplicating items or omitting items. In addition, the drawings and specifications must clearly delineate what is in the base scope of work and what is to be done by the E-rate contractor.
- Engaging a separate contractor to do E-rate-eligible work requires close coordination with the project's general contractor. The E-rate contractor's scope of work and schedule must be inserted into the overall project timeline.
- Applying for E-rate discounts requires the completion of a series of forms which must be filed within a certain time period. It is also required that a service provider be under contract prior to filing the final funding request form (Form 471). It is quite possible that the design documents may not be fully developed at the time the filing window is open. As a result, it makes the ability to effectively bid out the E-rate work and complete a contract award during the filing period a challenge.
- On SDA projects, the E-rate contract must be coordinated with the SDA procurement office.

An overview of the E-rate program, a complete eligible services list and required forms and filing deadlines can all be found on the following Web site:

<http://www.universalservice.org/si/>.

IV. Design Development

Upon approval of the schematic design documents, the design consultant refines the project to a point where all the major building systems have been identified, defined and coordinated. Again, the IT staff/IT review committee should have an approval role in reviewing the design development drawings and specifications. After the Final Educational Adequacy drawings are prepared, the Design consultant transmits the appropriate Design Development drawings, the revised educational specifications with the IT plan, and all applicable DOE project application forms to DOE OSF who, in turn, reviews the submission and determines final educational adequacy (FEA).

On some large projects there may be multiple submission delivery milestones at this phase (e.g. 50% and 100%) before the submission to DOE. SDA projects must follow the requirements set forth in the design manual. For other projects, the project team should determine the need for review of intermediate submissions.

A. Technology Related Deliverables

- Specifications using latest version of CSI/MasterFormat (see Section 5)
- Construction cost estimate

- Proof of compliance with the current DCA best practices standards document.
- Floor plan drawings showing symbols for devices including PA/clock, audio visual, CATV, voice/data outlets and wireless access points
- Riser diagrams of security and voice/data systems
- List of equipment to be furnished by SDA, District or School
- Review of coordination efforts regarding Electric, HVAC, and Building Management Systems
- Review of coordination efforts regarding building entrance facilities and service provider demarcation points.

B. Who Should Participate?

The level of detail at this stage is more complete and understandable. Therefore, all stakeholder groups should participate in this design phase by attending meetings and reviewing documents. At this phase, the technology users (teachers, administrators, support staff and students) confirm that the design consultant has properly incorporated their input from the preceding phases.

C. Who Should Review/Approve Deliverables?

The deliverables should be reviewed by the following groups:

- Superintendent
- Board/buildings & grounds committee
- The IT staff/IT review committee
- Teachers, administrators and support staff
- Students and community partners

The technology deliverables should be approved by the Superintendent and the IT staff/IT review committee.

V. Construction Document Phase

Upon approval of the design development documents, the drawings and specifications are further developed to a level of detail where competitive bids can be obtained. The IT staff/IT review committee should have an approval role over the technology-related contract documents. It is during this phase on large-scale projects that documents are reviewed by professionals at the Department of Community Affairs (DCA) for adherence to applicable building codes.

On some large projects there may be multiple submission delivery milestones at this phase (e.g. 50%, 75% and 100%). SDA projects must follow the requirements set forth in the design manual. For other projects, the project team should determine the need for review of intermediate submissions.

A. Technology Related Deliverables

- Final Specifications for PA/clock system, voice/data cabling, CATV system, telephone system, audio visual systems, security systems.
- Proof of compliance with DCA/Homeland Security requirements.
- Complete floor plan drawings showing symbols for devices including PA/clock, audio visual, CATV, voice/data outlets, wireless access points, cable tray, security system.
- Complete riser diagrams of security and voice/data systems.
- Equipment room layouts.
- Installation detail drawings.
- Separate set of contract documents for E-rate-eligible components (if required).
- Review of coordination efforts regarding Electric, HVAC, and building management systems.
- Review of coordination efforts regarding building entrance facilities and service provider demarcation points.

B. Who Should Participate?

All key stakeholder groups except the student/community group should participate in this last design phase. The project manager and IT staff/IT review committee can represent the student/community group at this point.

C. Who Should Review/Approve Deliverables

The technology deliverables should be reviewed by the following groups:

- Superintendent
- Board/Buildings & Grounds Committee
- IT Staff/IT Review Committee
- Teachers, Administrators and Support Staff

The technology deliverables should be approved by the superintendent and the IT Staff/IT review Committee.

VI. Construction Administration

This phase includes awarding the contract, building the project, testing, training and final acceptance. The visions and expectations of the IT staff, administration and other key technology stakeholders should come to fruition if the prior phases were successfully completed.

On an SDA project, bidding and contract award tasks are managed by the SDA and the design consultant as a separate phase. After the construction phase, there are separate phases for project close-out and post occupancy review.

On a smaller regular operating district project, proper bidding and contract award procedures must be followed by the district.

After an award has been made, construction administration tasks such as evaluating mock-ups, attending demonstrations, reviewing equipment model updates, equipment testing and system training are dealt with.

A. Submittal Process

Once the project has started, the contractor begins submitting product data (cut sheets) and installation detail drawings (shop drawings) to the design consultant via the PMF/CM, as applicable, for review and approval. These **submittals** represent the exact make and model of equipment the contractor intends to provide and how the equipment is to be installed. Submittals may also include mock-ups or samples of certain groups of components (e.g. a wall plate for a teacher's station showing voice/data/AV connections).

On a large-scale project, technology-related submittals are typically issued after the building's foundation and steel framework have been completed. On smaller projects, where technology is the major component, submittals begin shortly after award.

The design consultant reviews the submittals to determine if they satisfy the requirements of the drawings and specifications. If the contractor submits an alternate product, the design consultant determines if the alternate is acceptable.

It is during the submittal process that substitutions are made for technology products that are no longer available or no longer supported by the manufacturer. It is also during the submittal process where final details regarding color and style are made. (e.g. voice/data cable jacket color)

The IT staff/IT review committee should participate in the submittal review process for technology components.

B. Requests for Information (RFI) Process

As the contractor reviews the drawings and specifications and begins planning the work, it is inevitable that questions will arise. When they do, the contractor sends an RFI to the design consultant via the PMF/CM, as applicable. RFIs tend to fall into one of the following categories:

- Alternate installation method or material approval request.
- Conflict between drawings or between the drawings and specifications.
- A field condition that was not anticipated or covered on the drawings.
- Uncertainty as to the meaning of a particular drawing note or symbol.
- Missing information or incomplete installation details.

The IT staff/IT review committee should be copied on all technology-related RFI responses.

The RFI process is also employed during the bidding phase when interested bidders have questions about any of the material in the bid package (i.e. general terms and conditions, scope of work, individual specification sections, drawings, etc.)

C. Coordination among Contractors, Integrators, and Service Providers

Whether the project is a single prime contract with multiple subcontractors (i.e. mechanical, electrical, and plumbing) or a multiple prime contract (not done with the SDA), coordination among contractors is important. Typically, the electrical contractor will provide back boxes, conduit and power for technology systems and may even install certain technology equipment but often hires subcontractors to perform programming or final implementation tasks, such as programming a security system or telephone system. As mentioned previously, there may also be an E-rate contractor (service provider) on the job along with an IT systems integrator who is installing computers and printers. The important task of coordinating all these contractors is the responsibility of the PMF, CM or clerk of the works depending on how the project is structured. The IT staff/IT review committee and the school or district's project manager should regularly review coordination efforts with the PMF or CM.

D. Project Meetings

Regular project meetings are held with the entire project team. At these meetings, coordination issues are raised, schedules determined, critical path issues identified etc. The school or district's project manager should attend these meetings at a point in time when the technology work is ongoing or when a technology question is on the agenda. The project manager would then disseminate information to the other key stakeholder groups as necessary.

E. Periodic Site Visits

At appropriate intervals during the construction of the project, the design consultant reviews the work to determine if it is being performed in a manner that indicates that, when fully completed, the work will be in accordance with the construction documents. At a minimum, the school or district's project manager and/or someone from the IT staff/IT review committee should accompany the design consultant on these periodic site visits. Problems that are identified should be documented and addressed at a project meeting.

F. Testing and Training

All technology systems require some form of testing and many require user or system administrator training. Requirements for testing and training are covered in the specification documents and are typically part of the submittal/project closeout requirements.

Results of tests on fiber and copper voice/data cabling must be provided to the IT staff/IT review committee. These test results provide important cable infrastructure documentation and should be archived for future reference. As-

built drawings - that reflect the final installation conditions - must also be provided.

User training and system administration training must be coordinated with the IT staff/IT review committee. System administration training should be provided to a primary and secondary level of personnel to ensure that operations can withstand both a typical absence and a more serious, unanticipated problem.

G. Punch lists

As the project nears completion, the design consultant surveys and inspects the building and develops a punch list of items that are incomplete or incorrectly installed. The project manager and/or IT staff/IT review committee should accompany the design consultant when doing the technology systems review and should receive copies of all technology-related punch lists.

VII. SDA Design Manual References

Additional information on phase requirements as required on SDA projects can be found in the SDA's latest design manual.

- Design Criteria: Safety and Security
- Design Criteria: Information Technology
- NJ Department of Community Affairs - Best Practices
- Program/Concept Phase
- Schematic Design Phase
- Design Development Phase
- Construction Document Phase
- Bidding and Contract Award Phase
- Construction Administration Phase
- Project Close -out Phase